Measuring Ocean Color and Productivity

Internet Assignment – 15 points

In class, we are discussing the marine habitat and biological productivity in the oceans. In this internet-based activity, you will explore how light provides one of the basic tools for studying ocean processes such as ocean circulation and biological productivity.

On the class web site as part of this assignment, you can access the tutorial “Measuring Ocean Color: The Basics”. This PDF document will review previously covered topics such as the energy spectrum as well as introduce the new concept of using light energy to monitor the oceans.

As you read through the information provided, answer the following questions. As always, you may handwrite your answers on this worksheet, but remember if it cannot be read, it cannot be graded.

Measuring Ocean Color: The Basics (tutorial)

1. Concept Review: The sun produces energy in what three portions of the energy spectrum?

2. In the visible light portion of the energy spectrum, red is considered a (longer / shorter) wavelength; blue and violet are considered (longer / shorter) wavelengths. (Circle the correct answers)

3. Measurement of ocean color can provide information about:

4. Complete the M&Ms experiment referred to in the tutorial.
   Which wavelength of light (color) is absorbed first?
   Based on what you observe, explain why the ocean appears to have a blue-green color.
5. What causes water to be “turbid”?

6. Explain how living phytoplankton (chlorophyll pigments) interact with visible light.

7. In addition to phytoplankton, dissolved organic material (DOM) and suspended particulate matter (SPM) also affect the color of ocean water.
   a) Provide some examples of DOM and SPM materials.
   b) How do DOM and SPM interact with visible light?

8. a) What do the letters "C.Z.C.S." represent?
   b) What was this instrument designed to do?

   a) How much of the world’s ocean surface was mapped?
   b) How many images were gathered during the CZCS program?
The remaining portion of this assignment is based upon the images gathered from the CZCS program. The web site for these images can be accessed from the tutorial or from the following web link:

CZCS Classic Scenes

You will be exploring information from two locations: Tasmania and Southwest Africa. Note the map at the bottom of the web page provides locations of the regions being studied.

To begin, click on "Chapter 1: Tasmania".

1. Look at the image. Read the entire description.
   Why are the currents in this region so complex?

2. The image you are viewing is a "false color image". Explain in your own words what this means.

3. For this image of Tasmania, reds and yellows indicate ___________ phytoplankton productivity; blues and purples indicate ___________ phytoplankton productivity.

4. Which coastal area of Tasmania has the lowest productivity? (Circle the correct answer)
   north / south / east / west
   How does the image show this information?

At the bottom of the web page for Tasmania, you may click on the link to “Chapter 2: The Benguela Upwelling Zone” to continue to the next section.
5. In general, why do coastal areas usually have a higher productivity than the open ocean away from the coast? (Hint: think of the general source of nutrients along a coast.)

6. The Benguela Current along the Southwest African coast is known for productivity much higher than typical coastal areas.
   a) What is the process that contributes to this very high productivity?
      Hint: Scroll down to the bottom of the web page to find a link to an animation of the Benguela region. This animation will help you to visualize the process occurring here.

   b) Explain how deep waters of the ocean become enriched in nutrients.